Assembly and Operation

of the

HEATHKIT

TV CLOCK ACCESSORY

MODEL GRA-2000-1

Table of Contents

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit TV Clock Accessory, Model GRA-2000-1, causes the time of day to be shown on the picture tube of your Model GR-2000 Television Set just below the channel number. The time can be displayed for the same duration as the channel number, it can be shown continuously (with the channel number), or it can be eliminated entirely. You can select either a 12-hour or a 24-hour display of hours and minutes, with or without the display of seconds. The kit can be quickly built and is easily installed.

If you are going to assemble both the TV Set and the TV Clock Accessory, the TV Set should be assembled first.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedure.

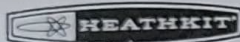Write to Heath Company for Price Information.

PARTS LIST

Check each part against the following list. The key numbers correspond to the numbers in the Parts Pictorial (fold-out from Page 3).

To order a replacement part, use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual.

KEY PART No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each	KEY PART No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
GENERAL					**General (cont'd.)**				
A1	1-26	1	100 kΩ, 1/2-watt resistor (brown-black-yellow)			344-54	1	Yellow wire	
A2	21-176	3	.01 μF disc capacitor		A4	443-617	1	Clock IC (DO NOT remove it from its container until you are so directed.)	
A3	56-56	2	1N4149 silicon diode						
	85-1305-1	1	Printed circuit board						
	134-862	1	Cable assembly with socket					Solder (Additional 3' rolls of solder, #331-6, can be ordered for 15 cents each.)	

KEY PART No.	PARTS No.	PARTS Per Kit	DESCRIPTION	PRICE Each
SWITCHES-CONNECTORS				
B1	64-666	1	Pushbutton switches, package of 3, consisting of:	
	64-667	1	Pushbutton H	
	64-668	1	Pushbutton F	
	64-669	1	Pushbutton S	
B2	432-133	1	Circuit board pin	
B3	432-134	2	Connector	
B4	432-777	30	IC connector (strip)	
B5	432-785	1	10-pin plug	

KEY PART No.	PARTS No.	PARTS Per Kit	DESCRIPTION	PRICE Each
HARDWARE (shown actual size)				
C1	250-56	2	6-32 x 1/4" screw	
C2	250-138	2	6-32 x 3/16" screw	
C3	254-1	2	#6 lockwasher	
C4	255-103	2	6-32 x 5/16" spacer	
MISCELLANEOUS				
	391-34	1	Blue and white label	
	597-260	1	Parts Order Form	
	597-308	1	Kit Builders Guide	
		1	Assembly Manual (See front cover for part number.)	

The above prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step procedures.

The resistor is designated by the color code and the resistance value. The symbol $k\Omega$ indicates 1,000 ohms. Capacitors are designated by their value and type. The symbol μF means microfarad.

Use the utmost care to prevent solder bridges between adjacent foil areas on the circuit board. A soldering iron rated at 15 to 25 watts is adequate.

The parts will be installed on the top side of the circuit board (the side with the component outlines) and the leads will be soldered to the foil (other) side. Solder the leads only to the foil side of the board. Before you cut off the excess length of each lead (as shown in the "Kit Builders Guide"), look at the foil to make sure the lead has been soldered.

CAUTION:

1. Before you cut off any IC connectors from the strip of 30 pins, you must make sure that these offset (staggered) pins will properly fit into the two rows of holes along the sides of the IC1 outline. Hold the strip so the connecting band is toward the outside of the IC outline, as shown in Detail 1A, and match the points of the connectors to the holes in the circuit board. It may be necessary to cut off and discard the connector on the end if it does not fit.

2. The clock IC is packaged with its terminals inserted into a conductive foam material to eliminate any electrostatic voltage buildup between terminals which might damage the IC. To avoid damage to the IC, DO NOT remove it from the conductive foam until you are so directed. Then save the conductive foam for use later.

Refer to Pictorial 1 and Detail 1A for the following four steps.

( ) Cut off a strip of 14 IC connectors which will fit the pin 1 side of the IC1 outline on the circuit board.

( ) Push the 14 IC connectors as far as possible into the holes on the pin 1 side of the IC1 outline on the circuit board. Be sure to keep the connecting band toward the outside of the outline. Solder the connectors to the foil.

( ) Cut off a strip of 14 IC connectors which will fit the pin 28 side of the IC outline.

( ) Push these 14 IC connectors as far as possible into the holes on the pin 28 side of the IC1 outline on the circuit board. Solder the connectors to the foil.

CAUTION: In the following step, before you apply downward pressure to insert the IC terminals into the connectors, make sure each IC terminal is centered in the opening of its connector. The IC terminals are very easily bent, so do not hesitate to inspect and straighten any terminal which does not properly enter a connector opening.
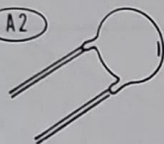
( ) Refer to Detail 1B and remove the clock IC from its container. Position the index cutout in one end of its body over the half-dot on the IC1 outline, and position the end of each IC terminal in the opening of a connector. Then apply downward pressure, as evenly as possible, to push the IC terminals down into the connectors.

( ) After the IC is seated into the connectors as far as possible, refer to Detail 1C and remove the connecting band from each IC connector strip by bending it back and forth until it breaks. Make the first bend toward the IC.
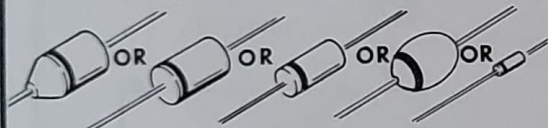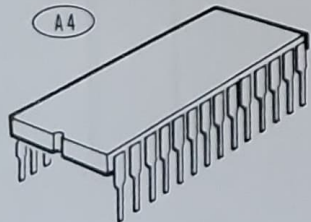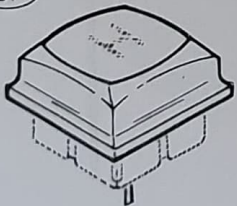
PARTS PICTORIAL

A1

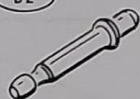A2

A3

NOTE: HEATH PART NUMBERS ARE STAMPED
ON MOST DIODES.

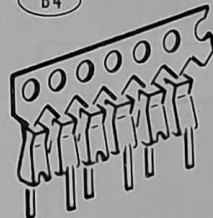OR   OR   OR   OR
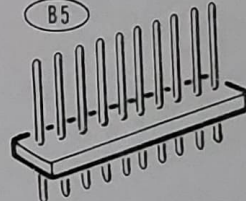
A4

B1

B2

B3

B4

B5

C1   C2   C3   C4

SPLAY

A

6 DIGIT

CHANNEL
AND TIME

B

C

READOUT
CIRCUIT BOARD

4 DIGIT

CHANNEL
ONLY

S301

YY

VIOLET

XX

ZZ

CONNECTOR

Figure 1

INSET

CONNECTING BAND

IC CONNECTORS

IC1

28

1

Detail 1A

HEATHKIT

IC TERMINALS

CONNECTING BANDS

STRIP OF IC CONNECTORS

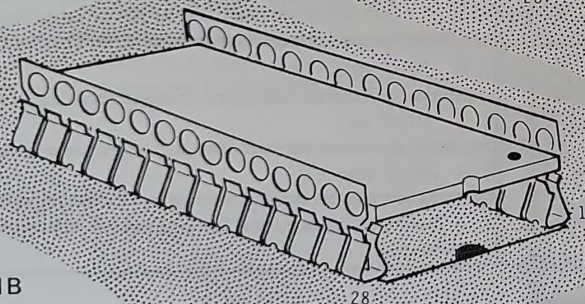INDEX CUTOUT
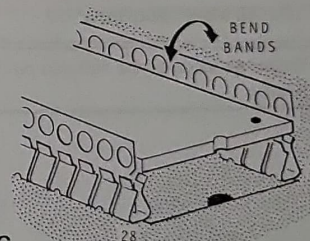
INSET

28

1

HALF DOT
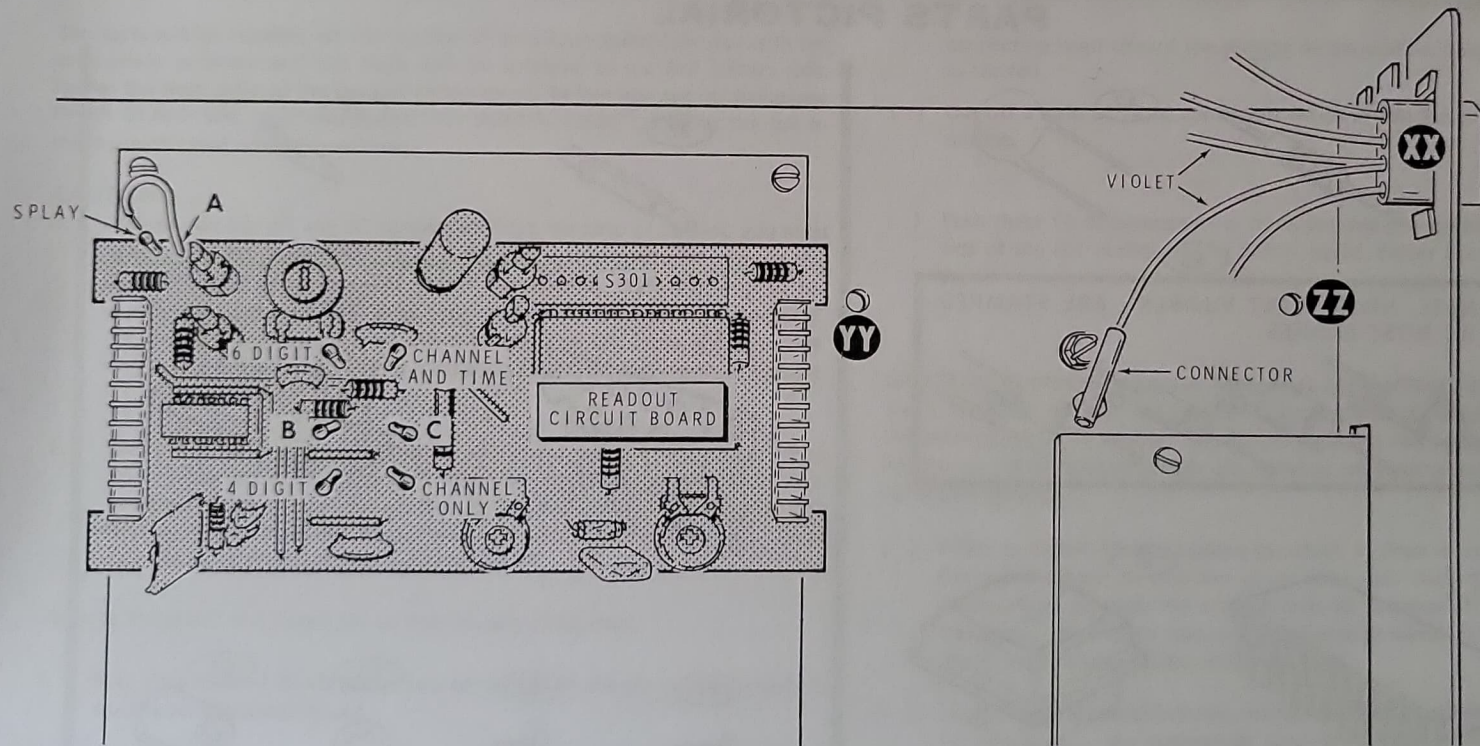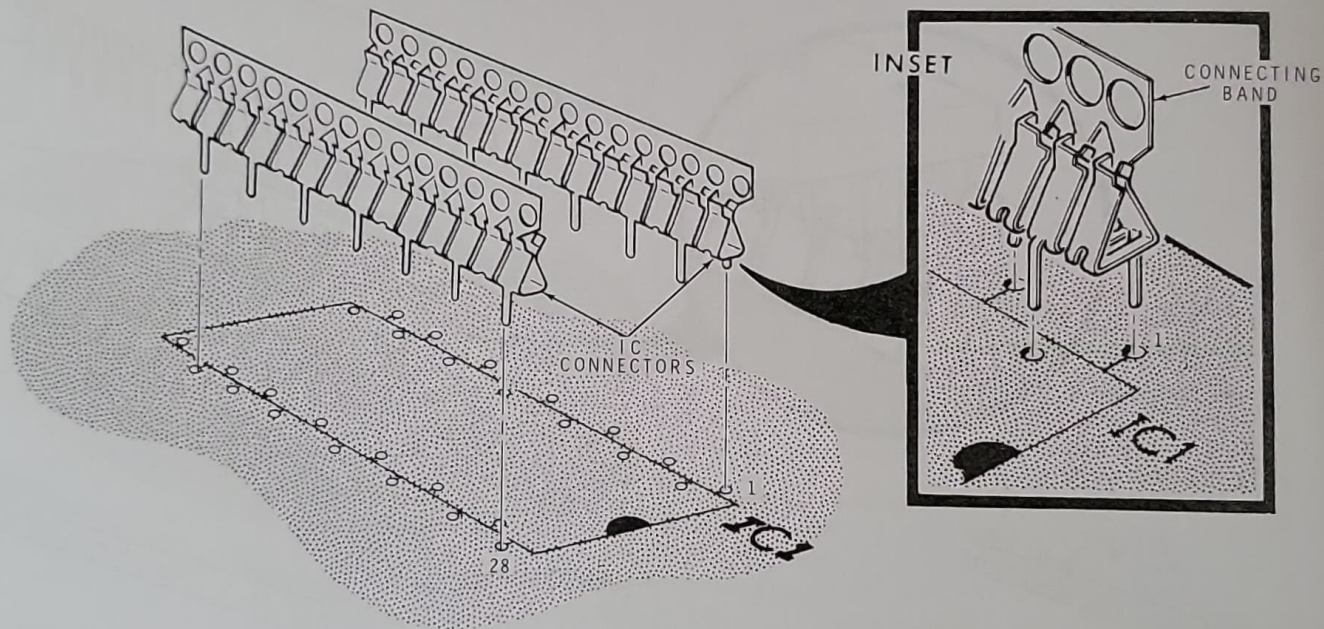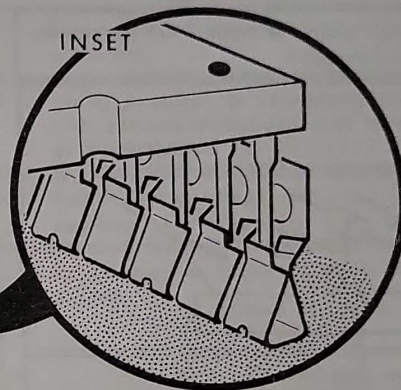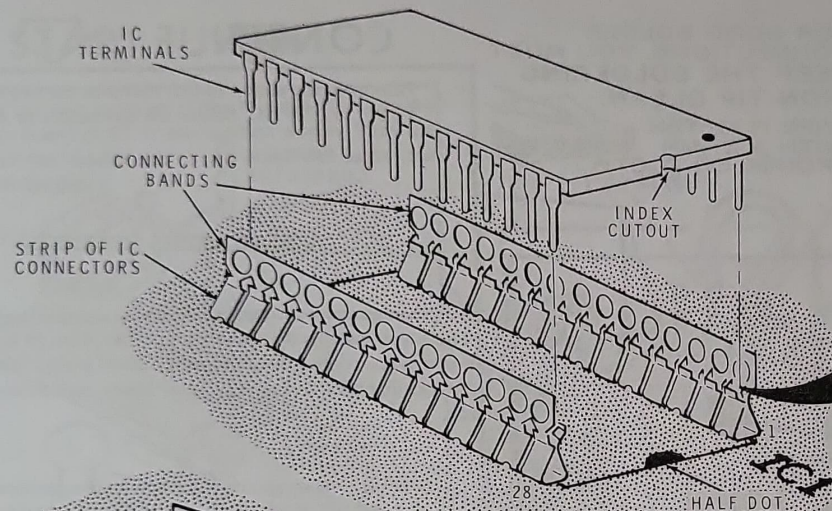
PICTORIAL 1

Detail 1B
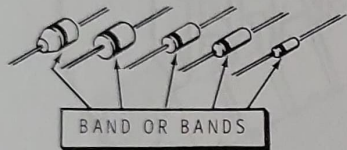
28

1

BEND BANDS

Detail 1C

28

1

START

Position the circuit board as shown. Then perform the steps in Pictorials 2 through 4.

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. ALWAYS POSITION THE BANDED END AS SHOWN ON THE CIRCUIT BOARD.

BAND OR BANDS

( ) 1N4149 diode (#56-56) at D1.

( ) 100 kΩ (brown-black-yellow).

( ) 1N4149 diode (#56-56) at D2.

( ) Solder all leads to the foil and cut off the excess lead lengths.

FOR GOOD SOLDER CONNECTIONS, YOU MUST **KEEP THE SOLDERING IRON TIP CLEAN.** WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.
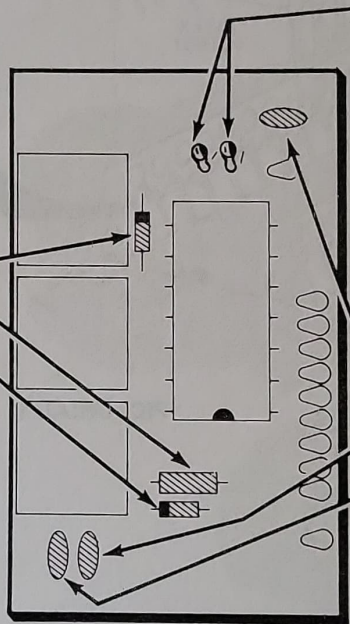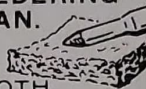
CONTINUE

( ) Push two connectors (#432-134) into the two holes at 12 HR and 24 HR. Solder the connectors to the foil.

FEMALE CONNECTOR PIN

RIDGE
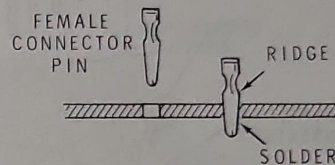
SOLDER

Before you install a disc capacitor, remove from its leads any excess body coating material which could protrude through the circuit board and cause a poor solder connection to the foil.

REMOVE COATING ON LEADS

( ) .01 µF disc.

( ) .01 µF disc.

( ) .01 µF disc.

( ) Solder all leads to the foil and cut off the excess lead lengths.

PICTORIAL 2

HEATHKIT

START ⬇

CONTINUE ▽

( ) Insert the two terminals of the H pushbutton into the circuit board at S1 in the position shown. Push the button flat against the circuit board and solder the pins to the foil.
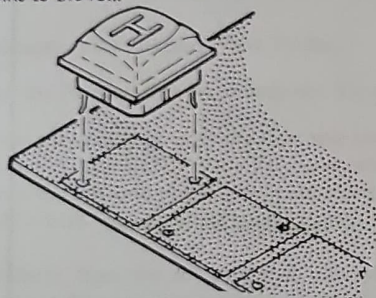
( ) S pushbutton at S2. Solder both pins to the foil.

( ) F pushbutton at S3. Solder both pins to the foil.
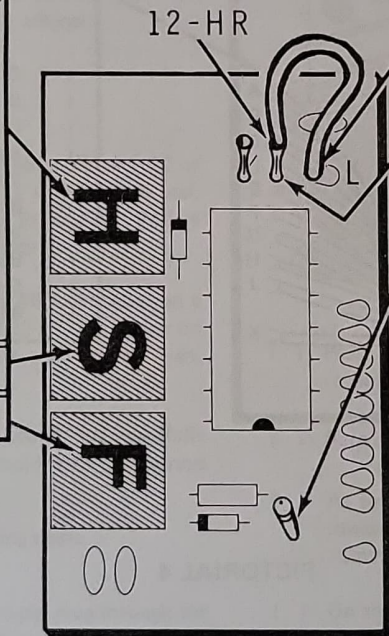
( ) Remove 1/4" of insulation from each end of a 2" yellow wire.

( ) Insert one end of the yellow wire into hole L and solder the wire to the foil. Cut off any excess length on the foil side.

( ) Push the free end of the yellow wire into the 12-HR connector.

( ) Circuit board pin (#432-133) at P1. Solder the pin to the foil.

12-HR

L

H S F

00

STOP RIDGE

FOIL SIDE   SOLDER

PICTORIAL 3

¾ ½ ¼ 0   1"   2"
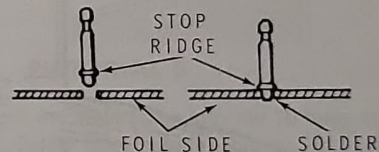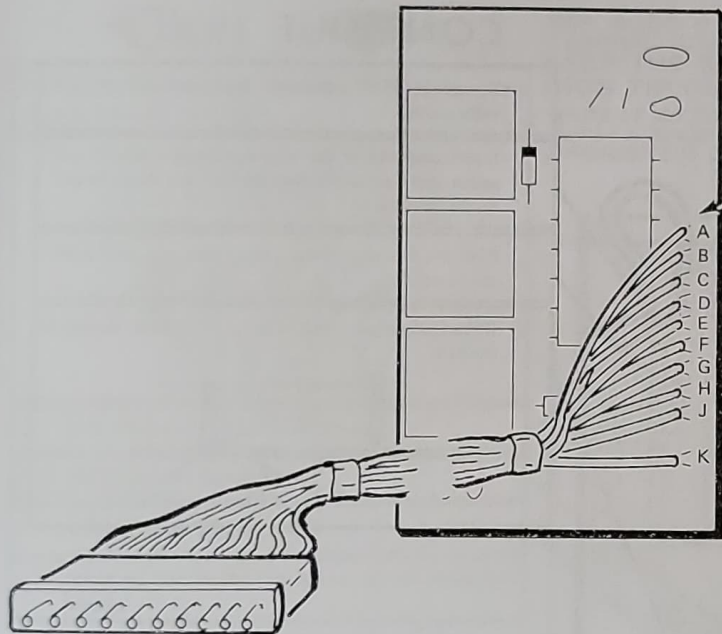
START

Connect the 10 cable wires to the lettered holes as follows:
Solder each wire to the foil and cut off any excess lead
lengths.

( ) Gray to A.
( ) Brown to B.
( ) Orange to C.
( ) Red to D.
( ) Yellow to E.
( ) Black to F.
( ) Violet to G.
( ) Blue to H.
( ) Green to J.
( ) White to K.

FINISH

PICTORIAL 4

HEATHKIT

INSTALLATION

NOTE: It will be easier to install the TV Clock Accessory if the TV Set is out of its cabinet.

Refer to Figure 1 (fold-out from Page 4) for the identification of the parts on the subchassis in the following steps.

( ) Disconnect the line cord of the TV Set.

( ) Pull the TV subchassis all the way out (forward).

( ) View the subchassis from the right side and identify holes YY and ZZ as shown in Pictorial 5. Place a #6 lockwasher on a 6-32 x 1/4" screw and, from the left side of the subchassis, insert the screw in hole YY. Place a 6-32 x 5/16" spacer on the screw. Tighten the screw into the spacer.

( ) Similarly, from the left side of the chassis, place a #6 lockwasher on a 6-32 x 1/4" screw and insert it in hole ZZ. Place a 6-32 x 5/16" spacer on the screw. Turn the spacer onto the screw threads with your fingers. Then, with pliers, tighten the spacer onto the screw.

(.) Refer to Figure 1 and identify the readout circuit board. Then carefully pull this circuit board out and off the pins which hold it to the channel selector circuit board underneath it.

Refer to Pictorial 6 (fold-out from Page 11) for the following steps.

( ) Refer to Detail 6A and push the long pins of the 10-pin plug through the conductive foam as shown. This is done so the voltage on the soldering iron tip will not damage the IC on the readout circuit board.
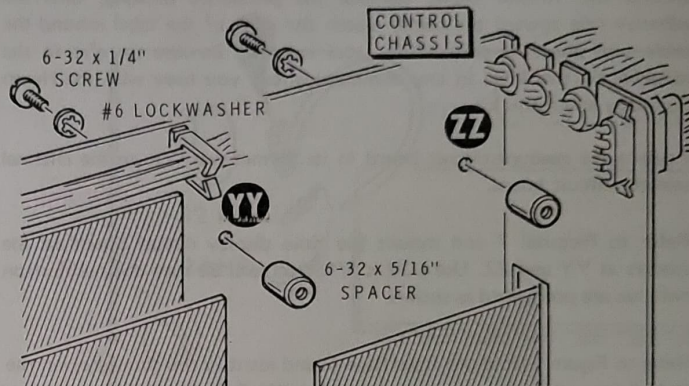
PICTORIAL 5

( ) Push the short pins of the 10-pin plug into the 10 holes at S301 on the readout circuit board. Solder the pins to the foil.

( ) Remove the conductive foam, which may now be discarded.

( ) As shown in Pictorial 6, position the cable socket with its beveled edge toward the edge of the circuit board and push the cable socket onto the 10-pin plug.

( ) On the readout circuit board, pull the wire coming from connector C out of the CHANNEL ONLY connector and push its end into the connector at CHANNEL AND TIME.

( ) Refer to Detail 6B and install the blue and white identification label around the 10-wire cable. Remove the protective backing, turn the adhesive side toward the cable, match the ends of the label around the cable, and press the ends of the label together. Be sure to refer to the numbers on this label in any communications you have with the Heath Company about this kit.

( ) Replace the readout circuit board in its former position on the channel selector circuit board.

( ) Refer to Pictorial 7 and mount the time display circuit board on the spacers at YY and ZZ. Use 6-32 x 3/16" screws. Be sure the pushbutton switches are positioned as shown.

( ) Refer to Figure 1 (fold-out from Page 4) and identify the connector on the end of the violet wire coming from socket XX. Push this connector all the way onto pin P1 (see Pictorial 7) on the time display circuit board.

NOTE: The "12-hour" clock system displays the hours from 1 through 12 twice every day. The "24-hour" clock system displays the hours 1 through 24 once a day. The latter is the display system used by the military and other services to avoid any confusion between AM and PM when making a time designation.

( ) Refer to Detail 7A and push the bare end of the yellow wire coming from L on the circuit board into either the 12 HR or the 24 HR connector, depending upon which type of time display you prefer.

( ) Turn the Television Set on. After you see a picture, change the channel. Time should now be displayed on the picture tube below the channel number. If you do not see the time numbers, refer to the "In Case of Difficulty" section of this Manual.

This completes the "Installation" of your TV Clock Accessory. Turn to the "Operation" section of this Manual for instructions on how to set the Clock to the correct time.

Detail 6B

HEATHKIT

YEL

12 HR

24 HR

H S F

Detail 7A

PIN P1

6-32 x 3/16"
SCREW
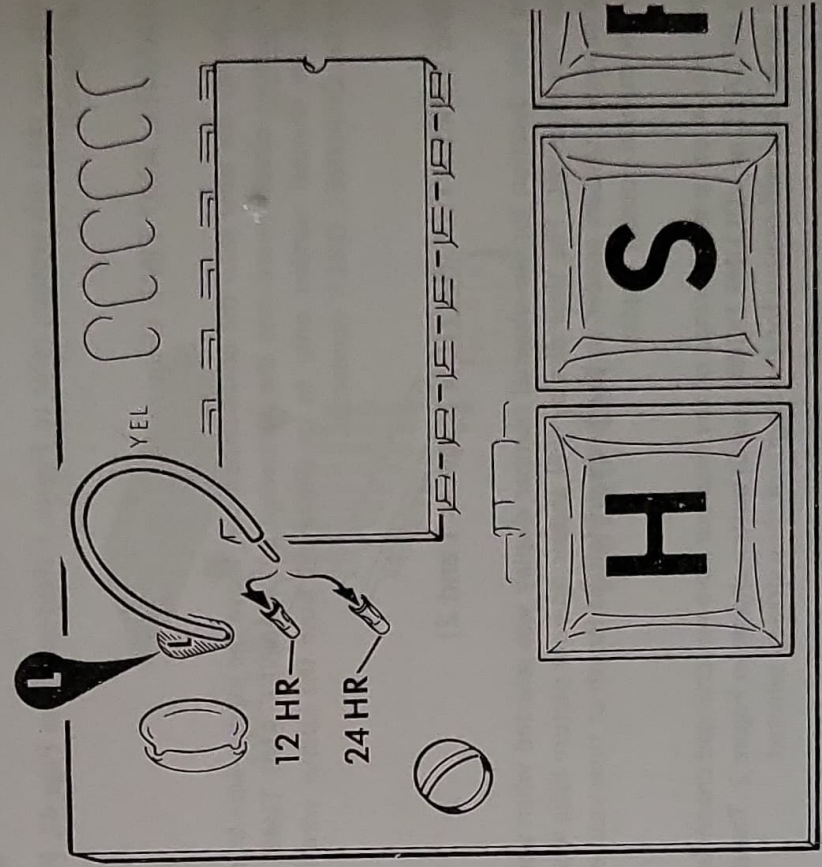
CONTROL
CHASSIS
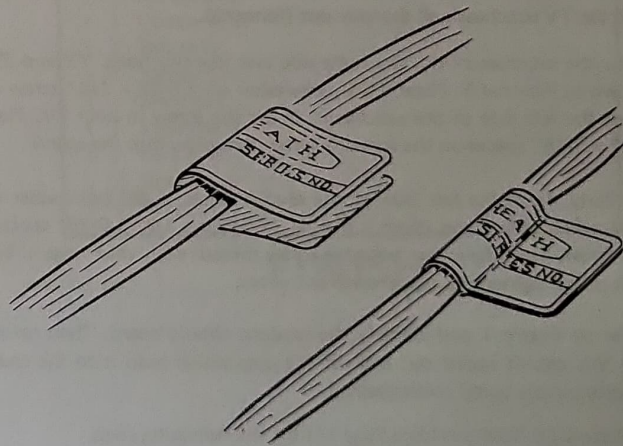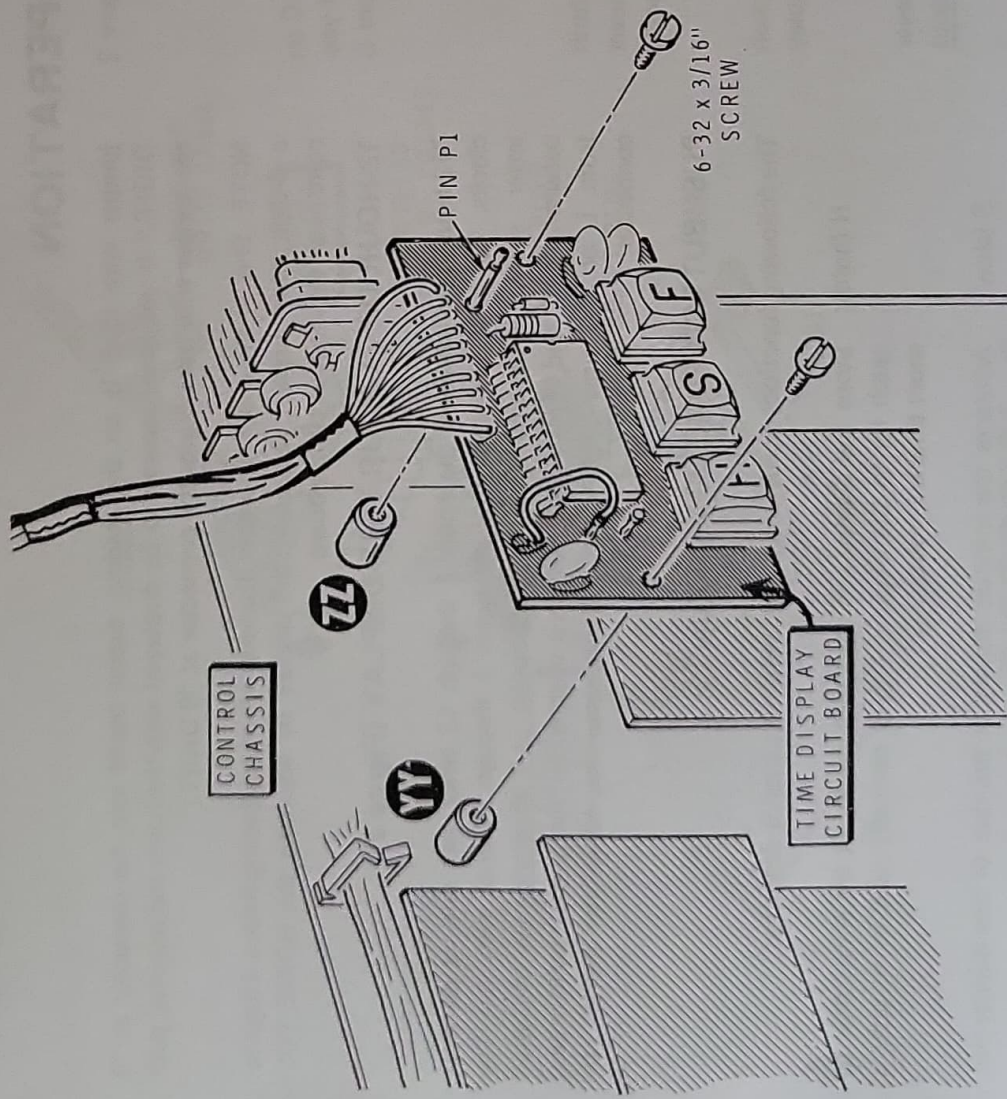
TIME DISPLAY
CIRCUIT BOARD

PICTORIAL 7

OPERATION

While you read this section, refer to Figure 1 (fold-out from Page 4), Figure 2 and Figure 3.

CHANNEL AND TIME (Figure 1)

To display the time with the channel number, move the jumper wire from C on the readout circuit board into the connector at CHANNEL AND TIME. If you want the channel number only to be displayed, push the jumper wire from C into the CHANNEL ONLY connector.

TIME DISPLAY DURATION (Figures 1 and 2)

The time duration for the channel number display was selected when you built your television set. The time display will appear on your picture tube whenever the channel numbers appear and will remain for the length of time you selected for the channel number display.

When you want to be informed of the time but have not changed channels, push the RECALL or VOLUME DOWN switch button shown in Figure 2. The display will appear and will remain for the length of time already selected.

If you want the display to remain on the picture tube continuously (whenever the television set is turned on), push the jumper wire from A on the readout circuit board into the DISPLAY connector.

SECONDS DISPLAY (Figure 1)

If you want the time display to consist of hours and minutes only, push the jumper wire from B on the readout circuit board into the connector at "4 DIGIT." If you want seconds to be displayed with the hours and minutes, push the jumper wire from B into the connector at "6 DIGIT."

NOTE: Should the channel number disappear when readjusting from a 4-digit to a 6-digit time display, reposition the display by adjusting the HORIZ POS control on the readout circuit board.
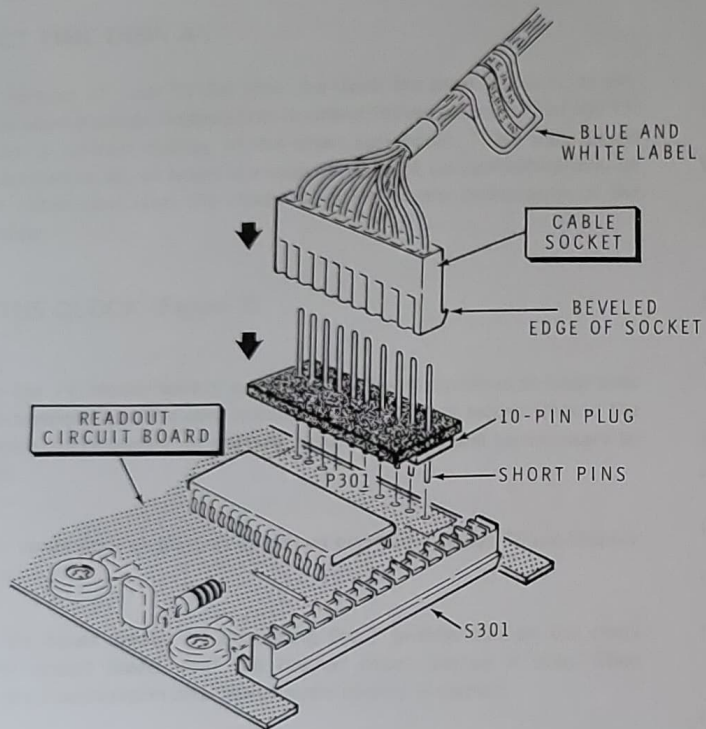
12-HOUR OR 24-HOUR TIME DISPLAY (Figure 3)

"12-hour time" displays the hours 1 through 12 twice each day, as do most clocks. "24-hour time" displays the hours 1 through 24 once each day. The latter system is becoming increasingly popular as it eliminates any confusion between "AM" and "PM". Either system is selected by inserting the jumper wire from L on the time display circuit board into the 12 HR or the 24 HR connector.

PUSHBUTTON FUNCTIONS (Figure 3)

The following functions occur only while the pushbutton is depressed:

H (hold): Stops the display and the Clock to permit the actual time to catch up to the display. This is normally used when only a short time is involved.

S (slow): Advances the minutes display at the rate of one minute per second (the seconds display is also speeded up).

F (fast): Advances the hours display at the rate of one hour per second (the minutes display is also speeded up).

BLUE AND WHITE LABEL

CABLE SOCKET

BEVELED EDGE OF SOCKET

READOUT CIRCUIT BOARD

10-PIN PLUG

SHORT PINS

P301

S301

PICTORIAL 6

CONDUCTIVE FOAM

LONG PINS

10-PIN PLUG
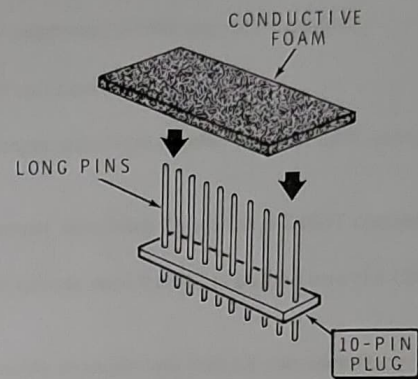
Detail 6A
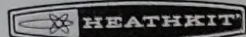
INCORRECT TIME DISPLAY

Upon initial turn-on of your TV Set after the clock has been installed, or any time there has been a power interruption (a power failure or turn-off of the TV master switch), a random display of the hours can occur. There may be no display of the hours at all, or hours in excess of 12 or 24 (as applicable) may be displayed. In either case, reset the clock according to the instructions in the following section.

SETTING THE CLOCK (Figure 3)

NOTE: When the TV master switch is ON, the Clock will continue to keep time as long as the television set line cord is connected to the wall outlet. Should the line cord become disconnected, or a power failure occur, it will be necessary to reset the Clock.

1. Obtain a continuous display, as described previously under "Time Display Duration."

2. Adjust the hours display by depressing the F pushbutton on the clock accessory circuit board until the desired hours display is seen. Then depress the S pushbutton until the minutes display is correct.

3. If you want your Clock exactly synchronized with a TV or radio station "time beep," the procedure consists of setting the Clock (in advance) to the time you expect to hear the time beep, and then stopping the Clock with the H (hold) button until you hear the beep. At this instant you

release the H button. Of course you must start soon enough so you will have time to perform the steps below.

( ) Pull the TV subchassis all the way out (forward).

On the readout circuit board:

( ) Push the jumper wire from A into the DISPLAY connector.

( ) Push the jumper wire from B into the 6 DIGIT connector.

( ) Be sure the jumper wire from C is pushed into the CHANNEL AND TIME connector.

NOTE: The following example will assume you want to synchronize your Clock at 12:00 hours (noon). Start the procedure about half a minute in advance.

( ) Depress the F button until the hours read "11."

( ) Depress the S button until the minutes read "59."

( ) Let the Clock run until the seconds read "00." Then quickly push and hold the H button. The clock will now read "12:00:00."

( ) When you hear the time beep, release the H button.

NOTE: If you do not want the time continuously displayed, pull the jumper wire out of the DISPLAY connector on the readout circuit board.

IN CASE OF DIFFICULTY

Try to analyze the symptoms of any problem you might have before starting any troubleshooting procedure. This can usually be accomplished by trying the various functions of your Clock Accessory to determine abnormal operations. A review of the "Operation" section may help your analysis. The "Troubleshooting Chart" lists a number of possible difficulties that could arise along with several possible solutions to those difficulties.

NOTE: Refer to the "Circuit Board X-Ray Views" on Page 17 for the physical location of parts on the circuit boards.

GENERAL TROUBLESHOOTING INFORMATION

1. Check all the wires that are connected to the circuit board and between the circuit board and other parts. Make sure these wires are connected to the proper points and are properly soldered. Someone who is not familiar with the unit may notice something you have consistently overlooked.

2. About 90% of the kits that are returned for repair do not function properly because of poor connections and soldering. Therefore, many troubles can be located by a careful inspection of connections to make sure they are soldered as described in the "Soldering" section of the "Kit Builders Guide." Reheat any doubtful connections. CAUTION: DO NOT reheat any IC connectors unless the IC is removed.

3. Closely examine the circuit board foil in a good light to see that no solder bridges exist between adjacent connections. If available, a magnifying glass would be helpful for this purpose. Remove any solder bridges by holding a clean, hot soldering iron tip between the two points that are bridged until the excess solder flows down onto the tip. Compare your foil pattern against the "Circuit Board X-Ray Views" on Page 17.

4. Check the integrated circuit for proper positioning. Be sure the dot or notched end of the IC is over the half dot printed on the circuit board. Be sure each IC pin has properly entered its socket.

5. Be sure the banded end of each diode is positioned correctly.

6. Check all component leads connected to the circuit boards. Make sure the leads do not extend through the circuit board and come in contact with other connections or parts.

If you still cannot locate and correct the trouble after the above tests are completed, and if a voltmeter is available, check the voltages against the values shown on the Schematic Diagram on fold-out from Page 19.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Service" section of the "Kit Builders Guide" and to the "Customer Service" information inside the rear cover of this Manual. Your Warranty is located inside the front cover.
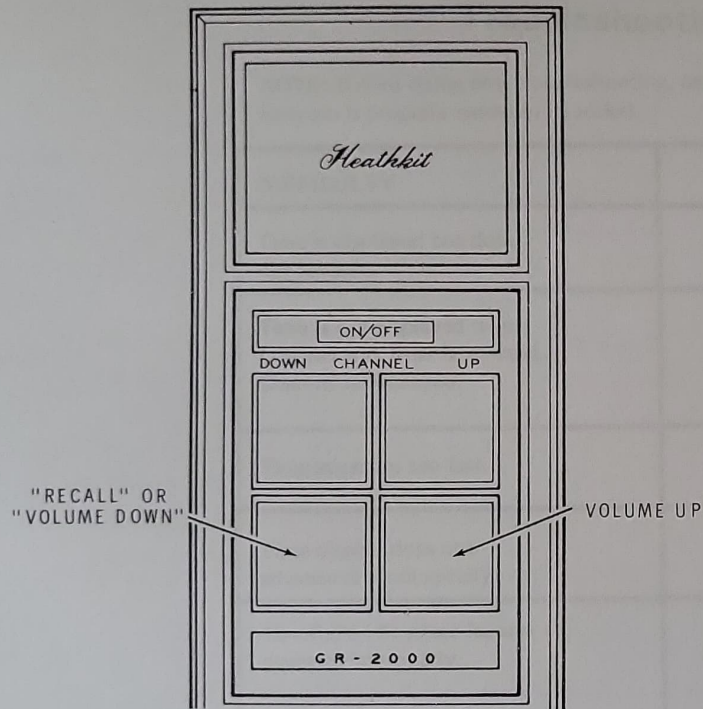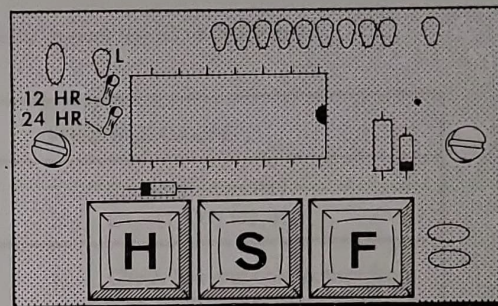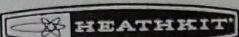
"RECALL" OR
"VOLUME DOWN"

VOLUME UP

Figure 2

Figure 3

HEATHKIT

Troubleshooting Chart

NOTE: Before doing any troubleshooting, carefully inspect the IC to make sure each pin is properly seated in its socket.

| DIFFICULTY	POSSIBLE CAUSE
Time is displayed but does not advance.	1. Connection to P1. 2. C1, R1, D1, D2, IC1.
Time is not displayed when Channel and Time is selected. Channel is displayed.	1. Check foil and connection from C to IC301 on readout board. 2. IC1. 3. IC301 on readout board.
Time advances too fast.	1. F or S pushbuttons shorted. 2. IC1.
Time display does not advance chronologically.	Wiring harness connections to time display board.
12-HR/24-HR select feature operates improperly.	1. Refer to "Operation" section for "Setting the Clock." 2. IC1. 3. Connections from L to IC1.

SPECIFICATIONS

Integrated Circuit . . . . Monolithic MOS integrated circuit using P-channel enhancement mode, low-threshold technology.

Time Base . . . . 60 Hz power line frequency.

Display . . . . Optional:

    1.   Hours and minutes

            or

        Hours, minutes, and seconds.

    2.   12-hour or 24-hour time display.

Time Setting . . . . By means of F (fast), S (slow), and H (hold) pushbuttons.

Logic Power Source . . . . Readout circuit board (+5 volts for logic 1 and −9 volts for logic 0).
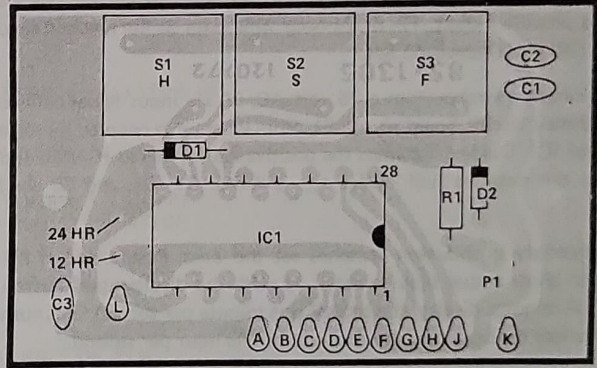
The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

CIRCUIT BOARD X-RAY VIEWS
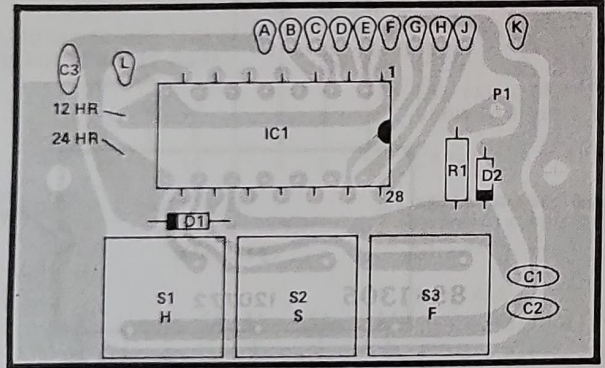
(Viewed from component side)

(Viewed from foil side)

CIRCUIT COMMENTS

While you read the following paragraphs, look at the connection diagram, Figure 4, and the Schematic Diagram.

IC1 is a monolithic, MOS integrated circuit. It contains all the logic circuitry required to provide 6-digit, 12- or 24-hour time data to the readout circuitry in the Model GR-2000 Television Set.
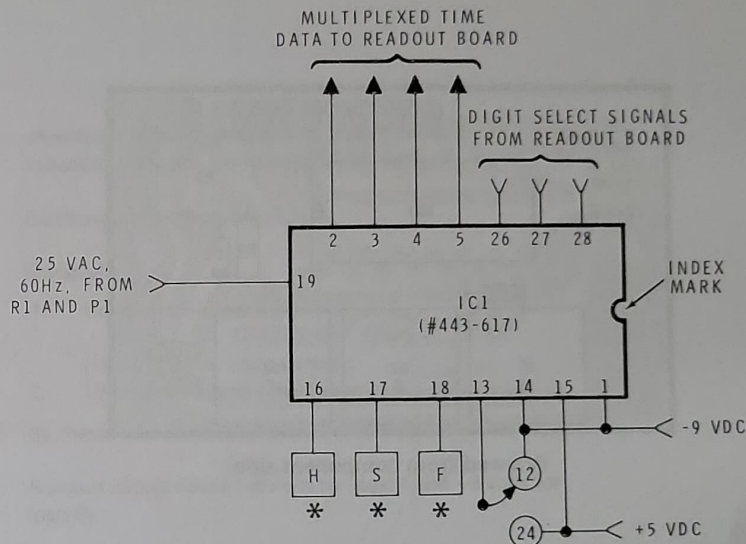
The clock circuit operates from a 25 volt AC, 60 Hz input signal connected to the time display circuit board at pin P1, from where it is coupled by resistor R1 to pin 19 of IC1. Diode D1 clamps the positive half cycles to +5 VDC and diode D2 clamps the negative half cycles to −9 VDC. C1, C2, and C3 are bypass capacitors.

Three momentary pushbutton switches set the time. Pushbutton H (S1) stops the clock to allow actual time to catch up with the display, pushbutton S (S2) advances the minutes display at a rate of one minute per second, and pushbutton F (S3) advances the hours display at a rate of one hour per second.

Either a 12-hour or a 24-hour time cycle can be displayed. This is accomplished by connecting pin 13 to pin 14 for a 12-hour display, or pin 13 to pin 15 for a 24-hour display. Voltages of +5 VDC and −9 VDC are supplied from the readout circuit board.

The time display can include hours, minutes, and seconds; or can be composed of hours and minutes only. This selection is made by connecting the jumper from connector B on the readout circuit board to connectors at "4 Digit" or "6 Digit."

Digit select voltages are supplied on wires G, H, and J from the readout board; and multiplexed time data is fed back to the readout board on lines B, C, D, and E.
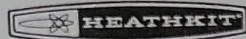
MULTIPLEXED TIME
DATA TO READOUT BOARD

DIGIT SELECT SIGNALS
FROM READOUT BOARD

25 VAC,
60Hz, FROM
R1 AND P1

2 3 4 5 26 27 28

19

IC1
(#443-617)

INDEX
MARK

16 17 18 13 14 15 1

−9 VDC

H   S   F   12
*   *   *

24   +5 VDC

*
H = HOLD. ALLOWS TIME TO CATCH UP TO
          THE DISPLAY.
S = SLOW. ADVANCES MINUTES DISPLAY
          AT 1 MINUTE PER SECOND.
F = FAST. ADVANCES HOURS DISPLAY AT
          1 HOUR PER SECOND.

Figure 4

IC Connections Diagram

NOTES:

1. THE VALUE OF THE 1/2 WATT, 10% TOLERANCE RESISTOR IS SHOWN IN OHMS (K=1000).

2. CAPACITOR VALUES ARE IN µF.

3. REFER TO THE "CIRCUIT BOARD X-RAY VIEWS" AND THE "CHASSIS PHOTOGRAPH" FOR THE PHYSICAL LOCATION OF PARTS.

4. SYMBOLS:

   ⬯ = A DC VOLTAGE TO CHASSIS.

   ☐ = A CIRCUIT BOARD CONNECTION HOLE OR PIN.

   ▽ = A CONNECTION TO CIRCUIT BOARD GROUND.

5. THE PRESENCE OF WAVEFORMS ON THE SCHEMATIC INDICATES USING AN OSCILLOSCOPE AT THAT POINT FOR CIRCUIT CHECKING. OSCILLOSCOPE GRATICULE ILLUSTRATED HAS 1CM SQUARES.
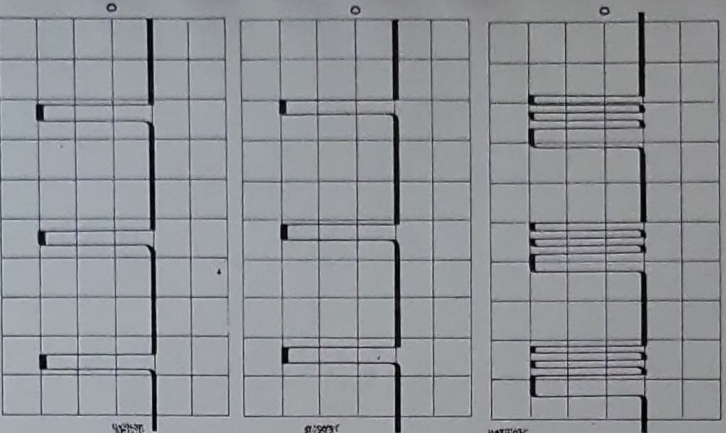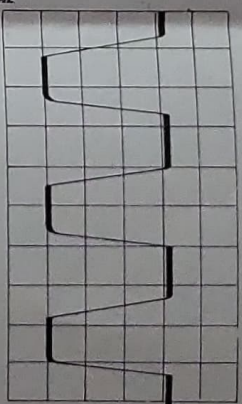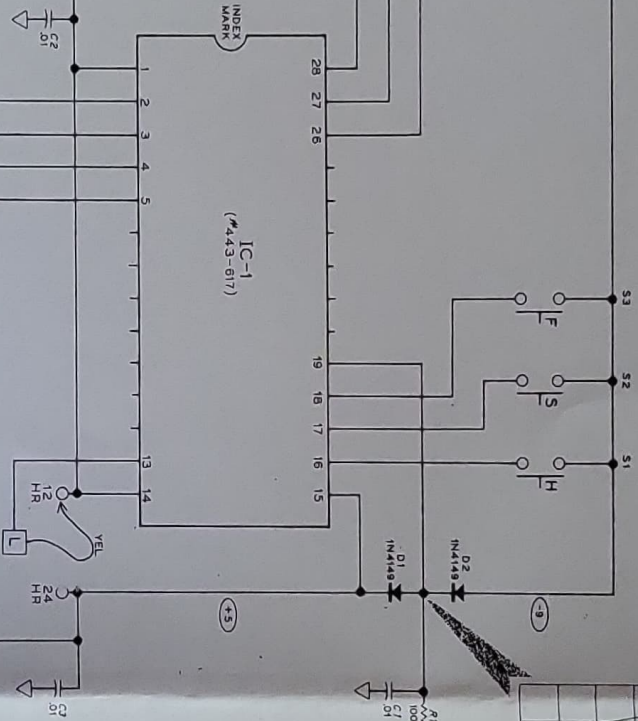
VERT. 5 VOLTS/CM
HORIZ - 20µS/CM

DIGIT SELECT
SIGNAL FROM
READOUT BOARD

G VIOL D_x 8
H BLU D_y 7
J GRN D_z 6
F BLK -9VDC

*BCD 8

E YEL 8
D RED 4
C ORG 2
B BRN 1
K WHT 10 ——— 5301

MULTIPLEXED TIME
DATA TO READOUT
BOARD

*NEGATIVE LOGIC

INDEX MARK

IC-1
(#443-617)

C2
.01

C3
.01

12 HR L YEL

24 HR

A GRY 9 +5VDC

28 27 26
1 2 3 4 5
19 18 17
16 15
13 14

S3 F
S2 S
S1 H

D1
1N4149

D2
1N4149

+5

-9

25 VAC, 60 HERTZ.
P1 FROM POWER
SUPPLY

R1
100K

C1
.01

SCHEMATIC OF THE
HEATHKIT®
TV CLOCK ACCESSORY
MODEL GRA-2000-1

VERT. 5 VOLTS/CM
HORIZ .5 ms/CM